

Date:

Subject (S.01)

$$a = \frac{dv}{dt}$$



$$a = 0 \text{ m/s}^2$$

$$a = \text{const}$$

$$a = 0 = \frac{dv}{dt}$$

$$a = \frac{dv}{dt}$$

$$\int dv = \int a dt$$

$$v = at + C$$

$$t = 0, v = v_0, x = x_0$$

$$C = v_0$$

$$v = v_0 + at$$

$$v = v_0 + at$$

$$x - x_0 = v_0 t + \frac{1}{2} at^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

$$v = \frac{dx}{dt}$$

$$v = \text{const}$$

$$v = \frac{dx}{dt}$$

$$v_0 + at = \frac{dx}{dt}$$

$$\int dx = \int (v_0 + at) dt$$

$$x = v_0 t + \frac{1}{2} at^2$$

$$a = \frac{dv}{dt} \cdot \frac{dx}{dv}$$

$$a = v \cdot \frac{dv}{dx}$$

$$\int a dx = \int v dv$$

$$v^2 = ax + C$$

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EX 2 :-

$$f = (8t - 5) \text{ m/s}^2$$

$$X_0 = 2 \text{ m} \quad V_0 = 12 \text{ m/s}$$

$V, X ? \rightarrow 10 \text{ Sec}$

Soln

$$f = \frac{dv}{dt}$$

$$\frac{dv}{dt} = 8t - 5$$

$$\int dv = \int (8t - 5) dt$$

$$V = \frac{8t^2}{2} - 5t + C$$

$$V_0 = 12 \quad t = 0$$

$$C = 12$$

$$V = 4t^2 - 5t + 12$$

$$\text{at } t = 10 \Rightarrow V = \checkmark \text{ m/s}$$

$$V = \frac{dX}{dt}$$

$$\frac{dX}{dt} = 4t^2 - 5t + 12$$

$$\int dX = \int (4t^2 - 5t + 12) dt$$

$$X = \frac{4t^3}{3} - \frac{5t^2}{2} + 12t + C$$

$$X_0 = 2 \quad t = 0$$

$$C = 2$$

$$X = \frac{4t^3}{3} - \frac{5t^2}{2} + 12t + 2$$

$$\text{at } t = 10 \Rightarrow X = \checkmark \text{ m}$$

EX 51-

$$F = -(a + bv^2)$$

$$V = 0 \xrightarrow{\text{Prove}} X = \frac{1}{2b} \ln\left(1 + \frac{bV_0^2}{a}\right)$$

Soln

$$F = V \cdot \frac{dV}{dx}$$

$$V \cdot \frac{dV}{dx} = -(a + bv^2)$$

$$\frac{1}{2b} \int \frac{2bV \cdot dV}{a + bV^2} = - \int dx$$

$$\frac{1}{2b} \ln(a + bV^2) = -X + C$$

$$V_0, X=0, t=0$$

$$C = \frac{1}{2b} \ln(a + bV_0^2)$$

$$X = \frac{1}{2b} \ln(a + bV_0^2) - \frac{1}{2b} \ln(a + bV^2)$$

$$X = \frac{1}{2b} \ln \frac{a + bV_0^2}{a + bV^2} \quad \text{at } V=0$$

$$X = \frac{1}{2b} \ln\left(1 + \frac{bV_0^2}{a}\right) \quad \text{X}$$

EX 1:-

$$V_0 = 30\sqrt{2} \text{ m/s}$$

$$F = (6 + 0.02X) \text{ m/s}^2$$

$$t = ?? \rightarrow X = 55 \text{ m}$$

So \hookrightarrow

$$F = v \cdot \frac{dv}{dt} \rightarrow V = \frac{dX}{dt}$$

$$F = v \cdot \frac{dv}{dX}$$

$$\int V dV = \int F dX$$

$$\frac{1}{2} V^2 = 6X + \frac{0.02}{2} X^2 + C$$

$$V_0 = 30\sqrt{2} \quad X = 55$$

$$C = 900$$

$$V^2 = 0.02 X^2 + 12X + 1800$$

$$V = \sqrt{0.02 X^2 + 12X + 1800}^{\frac{1}{2}}$$

$$\frac{dX}{dt} = \sqrt{0.02 X^2 + 12X + 1800}^{\frac{1}{2}}$$

$$\int \frac{dX}{\sqrt{0.02 X^2 + 12X + 1800}} = \int dt$$

$$\begin{aligned} X^2 + aX + b \\ \left(X + \frac{a}{2}\right)^2 + b - \left(\frac{a}{2}\right)^2 \end{aligned}$$

$$\int \frac{dX}{\sqrt{X^2 + 600X + 90000}} = \int \sqrt{0.02}$$

$$\int \frac{dX}{\sqrt{(X+300)^2}} = \int \sqrt{0.02} dt$$

$$\int \frac{dX}{X+300} = \int \sqrt{0.02} dt$$

$$\ln(X+300) = \sqrt{0.02} t + C$$

$$t = 0, X = 0$$

$$C = \ln(300)$$

$$\ln(X+300) = \sqrt{0.02} t + \ln 300$$

$$\sqrt{0.02} t = \ln \frac{X+300}{300}$$

$$t = \frac{1}{\sqrt{0.02}} \ln \frac{X+300}{300} \neq$$